CLAIMS

What is claimed is:

1. A ribbon beam ion implantation system comprising:

an ion source operable to generate multiple ion species from a source material;

an extraction system configured to extract the ion species from the ion source and generate a ribbon-shaped ion beam; and

a mass analyzer comprised of a first permanent magnet and a second permanent magnet that generates a substantially uniform magnetic field across a beam path of the ribbon-shaped ion beam to select a species from the multiple species initially present in the ribbon-shaped ion beam.

2. The system of claim 1, further comprising an acceleration system aligned along the beam path that operates on the ion beam after the mass analyzer and accelerates or decelerates the ion beam to a predetermined implantation energy level.

3. The system of claim 1, wherein the extraction system is a triode extraction system operative to produce a converging beam.

4. The system of claim 1, wherein the ion beam extracted by the extraction system is at a relatively low energy.

5. The system of claim 4, wherein the relatively low energy is about 500 eV.

6. The system of claim 1, wherein the magnetic field generated by the mass analyzer has a length of about 5 cm through which the ion beam travels.

7. The system of claim 1, wherein the magnetic field is oriented along the ribbon-shaped ion beam's short dimension.

8. The system of claim 1, wherein the magnetic field is relatively high with rapidly decaying fringes.

9. The system of claim 1, wherein the multiple species include B+, F+, BF1+ and BF2+, and the selected species is B+ or BF2+.

10. The system of claim 1, wherein the multiple species include P+ and H+ and the selected species is P+.

11. The system of claim 1, wherein the source material comprises boron trifluoride (BF3).

12. The system of claim 1, wherein the source material comprises phosphorous pentafluoride (PF5).

13. The system of claim 1, wherein the source material comprises arsenate (As5).

14. The system of claim 1, wherein the ion beam has a width of about 300 mm.

15. The system of claim 1, further comprising an end station having a wafer, wherein the ion beam is operative to implant the selected species on the wafer in a single pass.

16. The system of claim 1, wherein the extraction system comprises a control circuit operable to receive one or more inputs indicative of a desired ion species, and output a set of predetermined voltages for electrodes associated with the extraction system based on the one or more inputs.

17. The system of claim 16, wherein the set of predetermined voltages dictates an extraction energy of the ribbon-shaped ion beam entering the mass analyzer.

18. A mass analyzer system that selects and removes species from a ribbon-shaped ion beam comprising:

a first permanent magnet located above a ribbon beam path;

a second permanent magnet located below the ribbon beam path, wherein the first permanent magnet and the second permanent magnet are oriented so as to deflect a passing ribbon-shaped ion beam across its short dimension; and

an extraction system associated with a ribbon-shaped ion source, operable to extract a ribbon-shaped ion beam therefrom at a plurality of different energies, wherein an energy of the extracted ribbon-shaped ion beam is a function of a desired dopant species.

19. The mass analyzer system of claim 18, wherein the first permanent magnet and the second permanent magnet have a slight curvature to match the ribbon beam path.

20. The mass analyzer system of claim 19, wherein the extraction system comprises a control circuit operable to receive one or more inputs indicative of a desired ion species, and output a set of predetermined voltages for extraction electrodes associated with the extraction system based on the one or more inputs.

21. A method of generating a ribbon type ion beam comprising:

generating multiple ion species from an ion source;

extracting the multiple ion species to form a ribbon-shaped ion beam having a short dimension and a wide dimension, wherein the wide dimension is substantially larger than the short dimension; and

selecting a species and rejecting other species of the multiple species of the ion beam *via* a permanent magnet based mass analyzer.

22. The method of claim 21, further comprising accelerating/decelerating the ion beam to a desired energy level after selecting the species.

23. The method of claim 21, further comprising directing the ion beam towards a target wafer at an end station.

24. The method of claim 23, further comprising performing an ion implant on the target wafer with the ion beam in a single pass, wherein the target wafer has a diameter of about 300 mm and the wide dimension of the ion beam is greater than about 300 mm.

25. The method of claim 21, wherein the species is selected by applying a magnetic field *via* permanent magnets that deflects the ion beam across its short dimension.

26. The method of claim 21, wherein extracting the multiple ion species comprises:

identifying the selected species; and

configuring extraction electrodes with a set of predetermined voltages such that the extracted ribbon-shaped ion beam has an energy that is a function of the identified selected species.